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First MINIBALL experiment at HIE-ISOLDE

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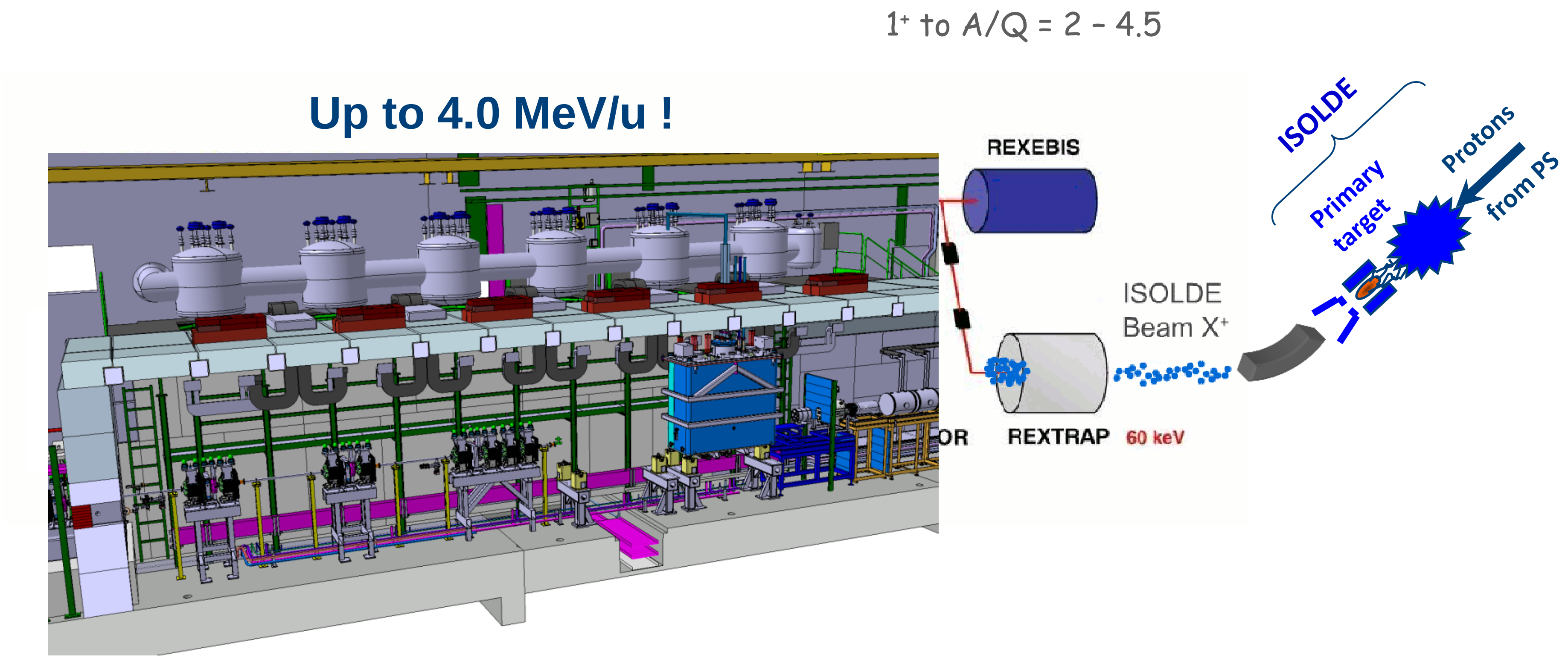
OUTLOOK

- The ISOLDE facility
- The MINIBALL array
- Why COULEX?
- First Experiment at HIE-ISOLDE: IS557

The ISOLDE facility

From REX-ISOLDE to HIE-ISOLDE



Total efficiency : 1 -10 %

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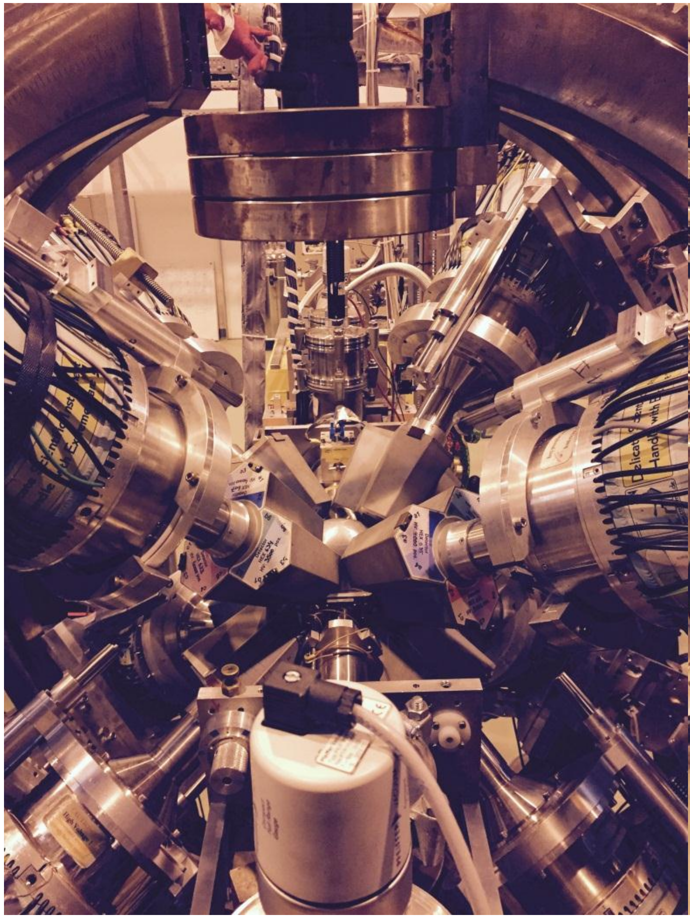
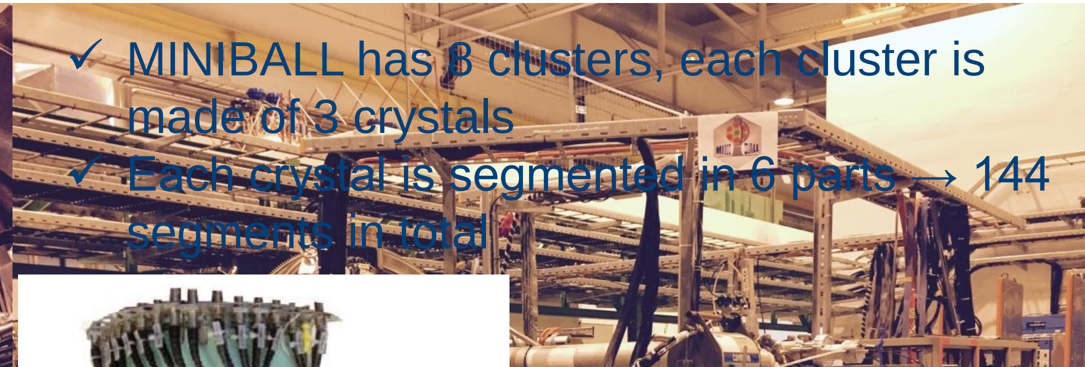
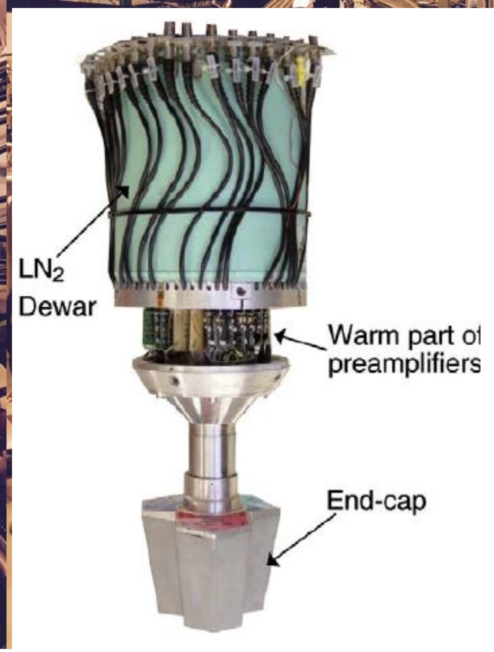
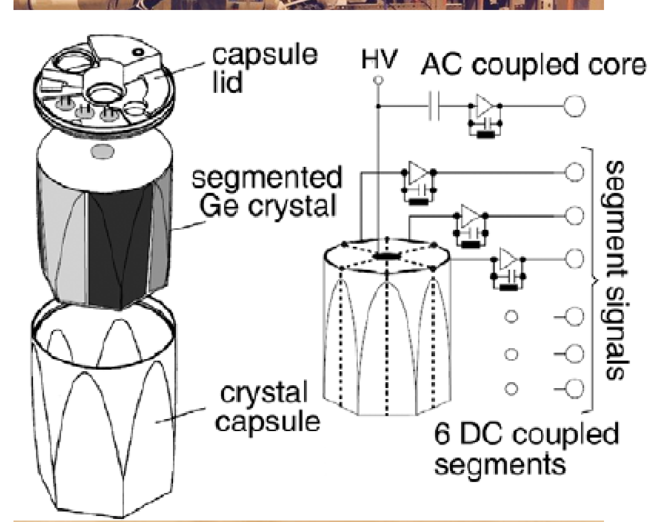
The MINIBALL array





- ✓ MINIBALL has 8 clusters, each cluster is made of 3 crystals
- ✓ Each crystal is segmented in 6 parts → 144 segments in total





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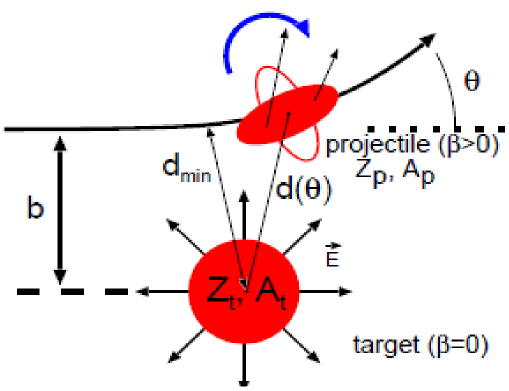
WHY COULEX?

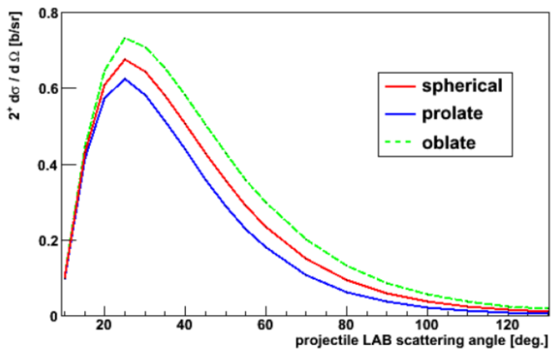
COULEX is the most powerful and direct experimental method to study nuclear collectivity and shapes.

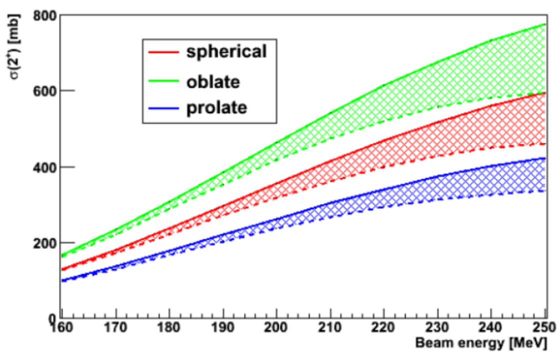
- ✓ Excitation mechanism is purely electromagnetic. The only nuclear properties involved → matrix elements of the electromagnetic multipole moments.

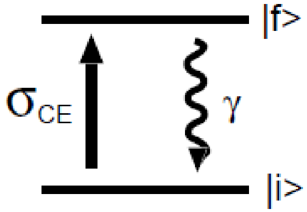
$$B(E2; 0^+ \rightarrow 2^+) = \langle 0^+ || E2 || 2^+ \rangle^2$$

- ✓ Bringing information on Qs and relative signs of matrix elements → direct distinguish between prolate and oblate shape. $\langle 2^+ || E2 || 2^+ \rangle = \frac{1}{0.7579} Q_2$



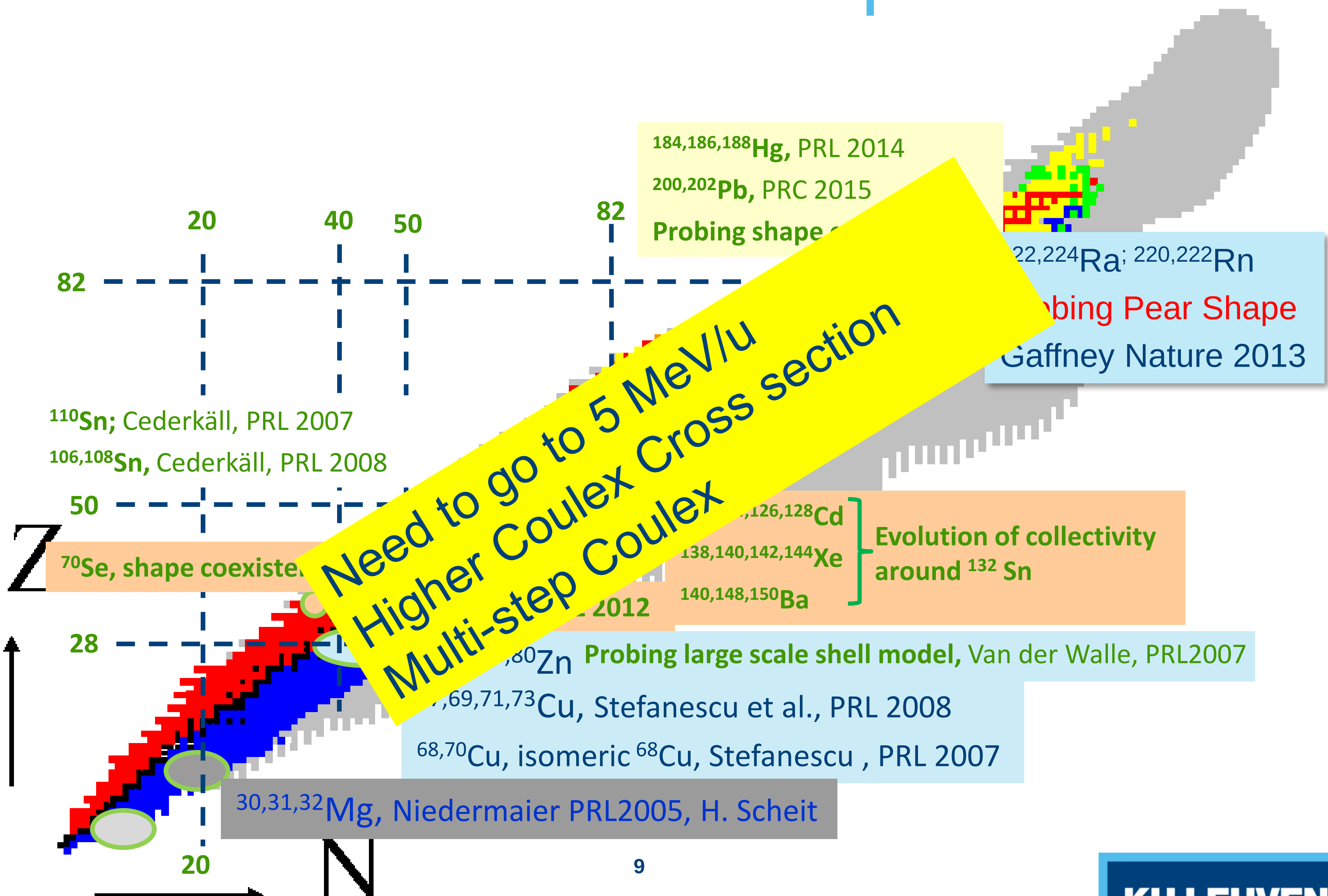






Observables: Transition energies and intensities
→ **Determine new excited levels and study deformations**

Previous COULEX experiments



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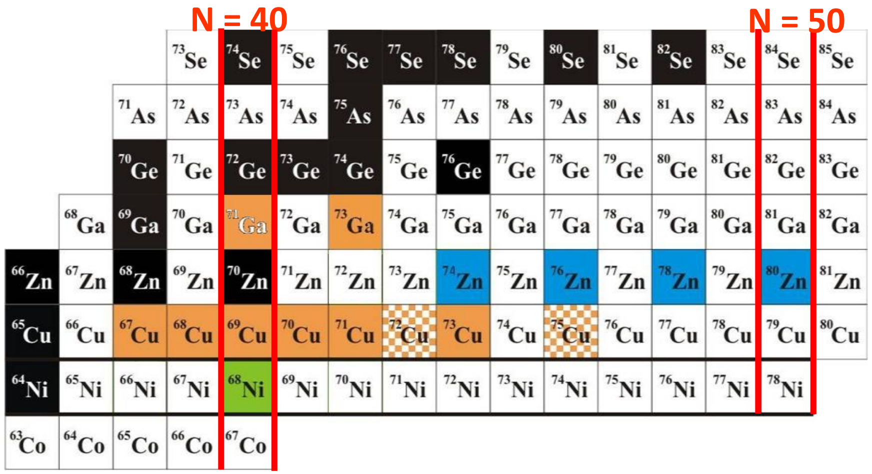
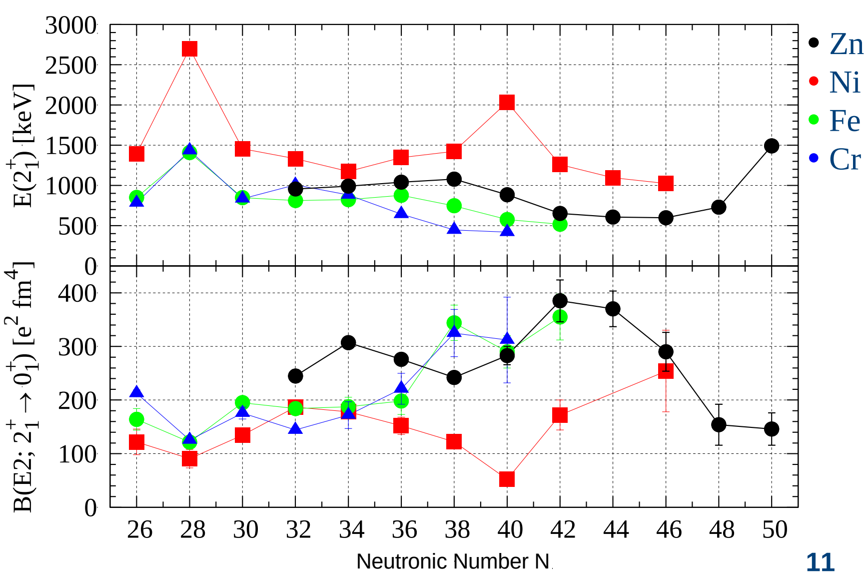
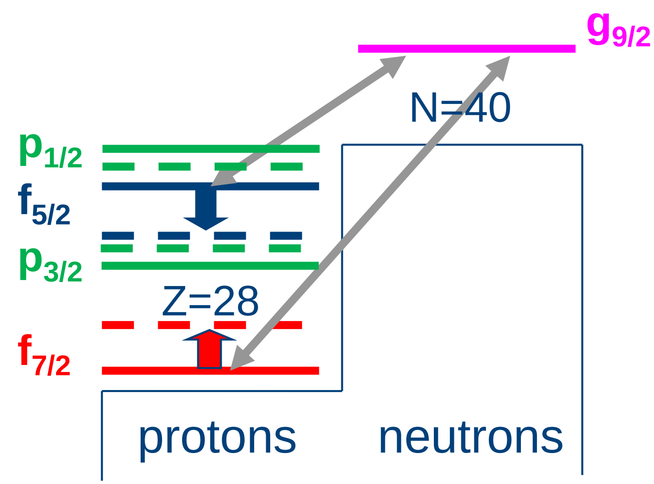
First experiment at HIE-ISOLDE



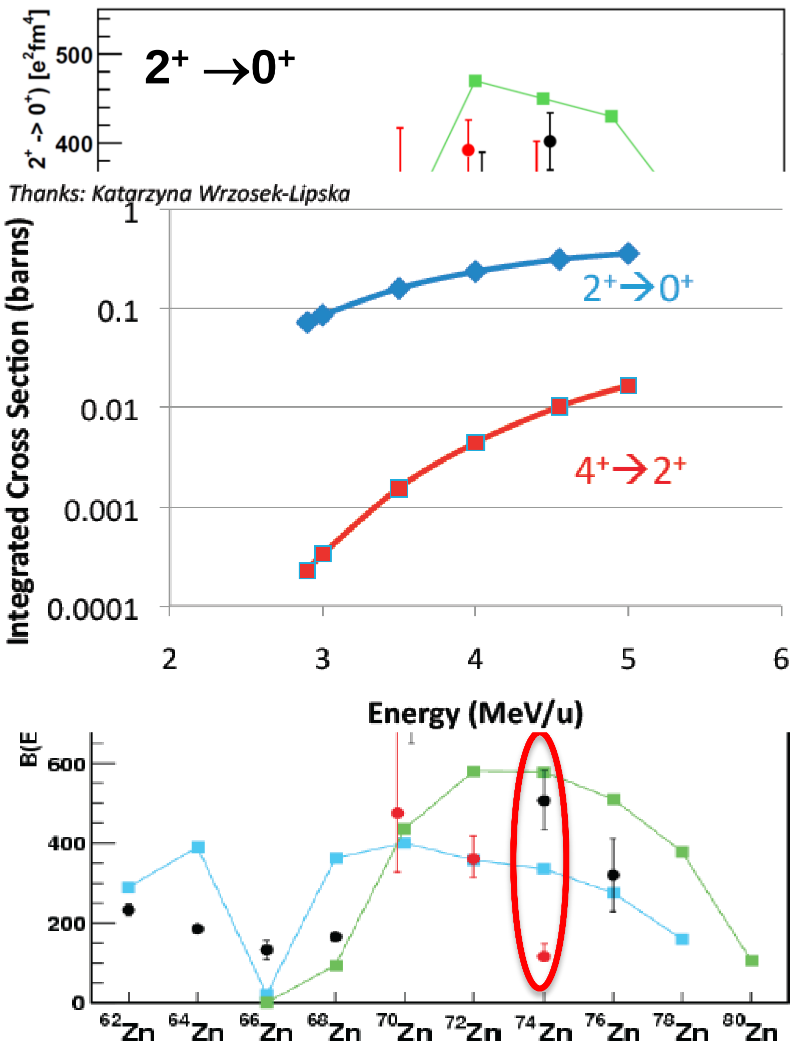


Coulomb excitation ^{74}Zn - ^{80}Zn (N=50): probing the validity of shell-model descriptions around ^{78}Ni



Reduction of the proton $f_{5/2}$ - $f_{7/2}$ gap when filling $\upsilon g_{9/2}$

First experiment at HIE-ISOLDE



Why and what?

- ✓ Large disagreement for ^{74}Zn B(E2).
- ✓ The reduced value for ^{74}Zn is not predicted by any model.
- ✓ Measure B(E2: $2^+ \rightarrow 0^+$), B(E2: $4^+ \rightarrow 2^+$) and B(E2: $6^+ \rightarrow 4^+$).
- ✓ Measure Quadrupole moments.
- ✓ Clarify discrepancies with half-lifes measurements.
- ✓ Observation of 4^+ in ^{80}Zn.
- ✓ Identification of low lying no-yrast states.

Which is the advantage of using beams with more energy?

- ✓ High-lying states can be more efficiently populated (still in safe COULEX regime)

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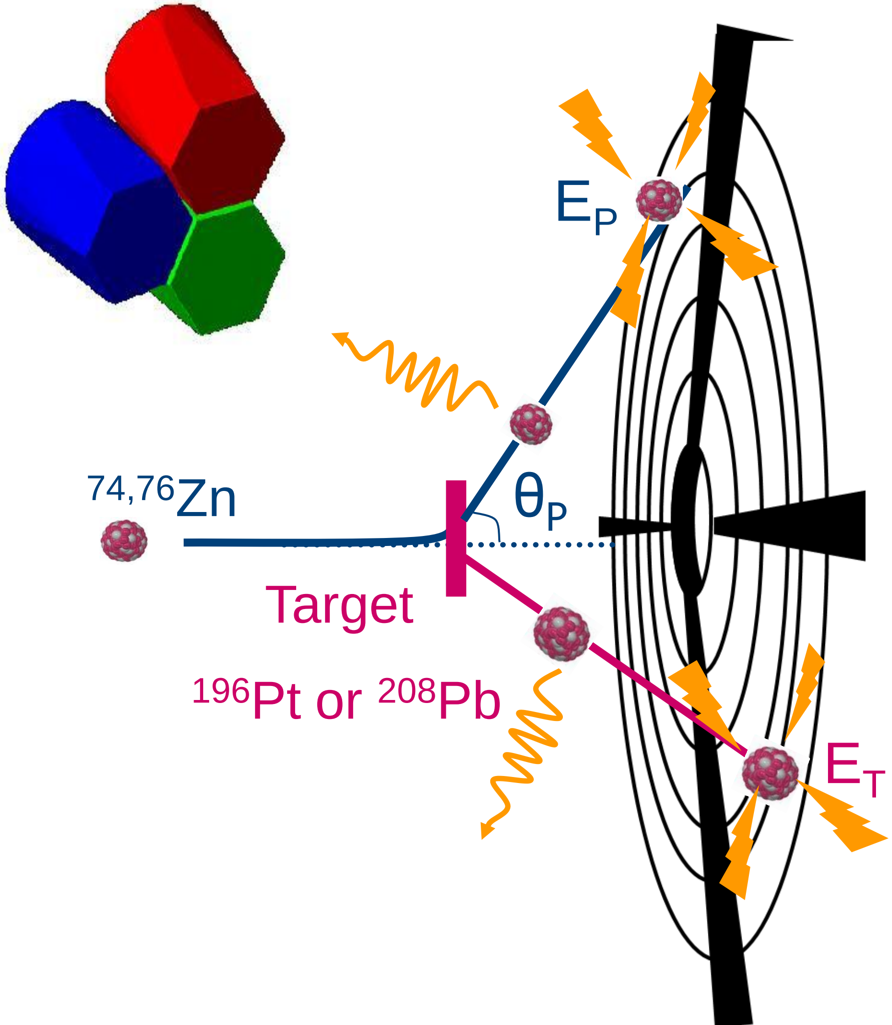
First experiment at HIE-ISOLDE

We measured during 3 weeks, but only 6h/daily work and 4 nights.

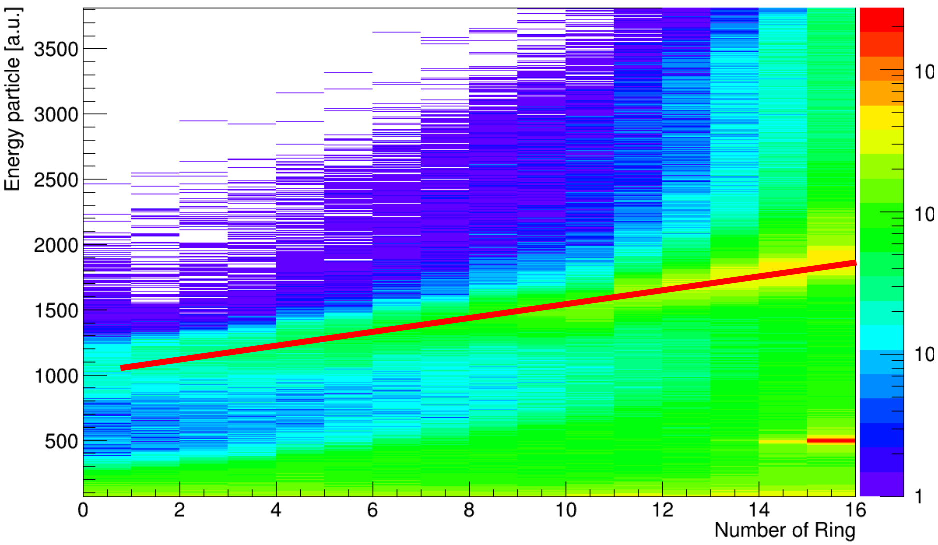
2 different targets had been used:
^{196}Pt (2 mg/cm^2) and ^{208}Pb (4 mg/cm^2)

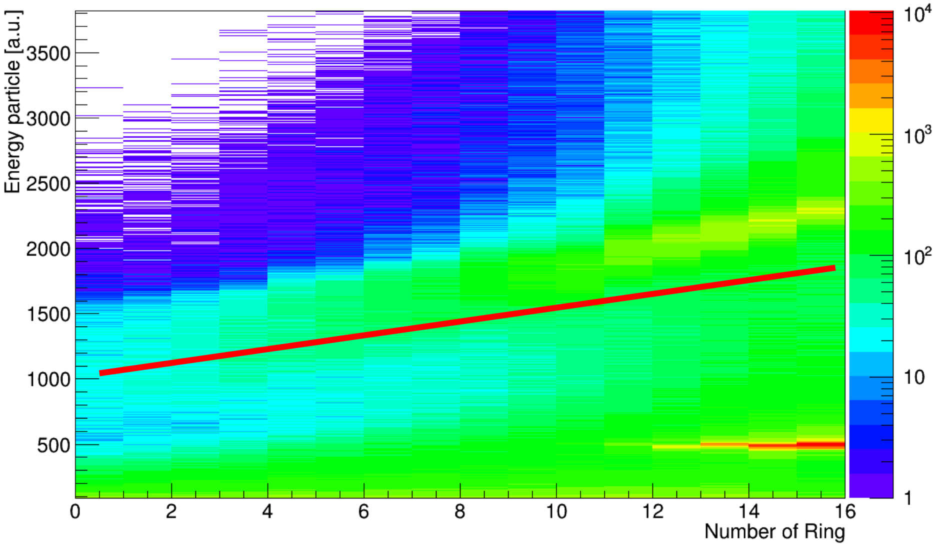


Isotope	Target	Energy (MeV/u)	Intensity (pps)	Total hours
^{74}Zn	^{196}Pt	2.85	~ 1.0 10^6	28
	^{196}Pt	4.0	~ 1.0 10^6	7
	^{208}Pb	4.0	~ 1.0 10^6	31
^{76}Zn	^{196}Pt	2.85	~ 5.0 10^5	20
	^{208}Pb	4.0	~ 5.0 10^5	14

First experiment at HIE-ISOLDE

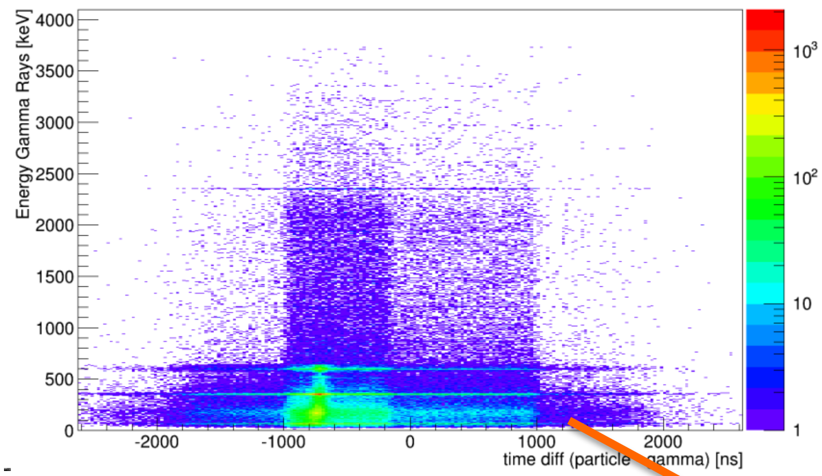
Different energies different kinematics

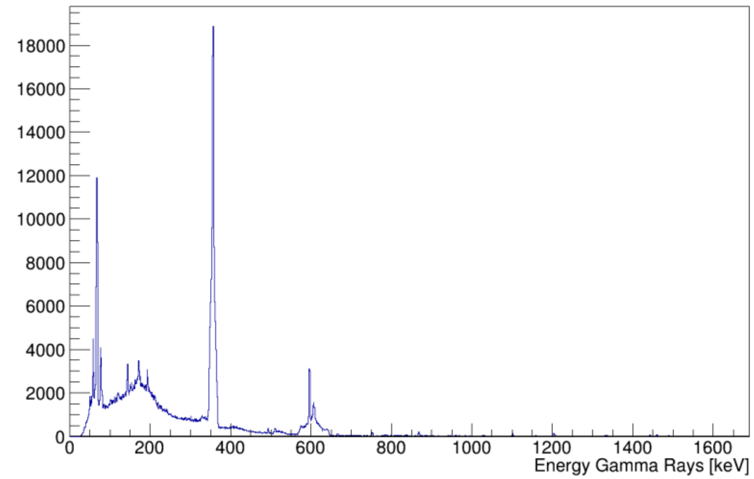


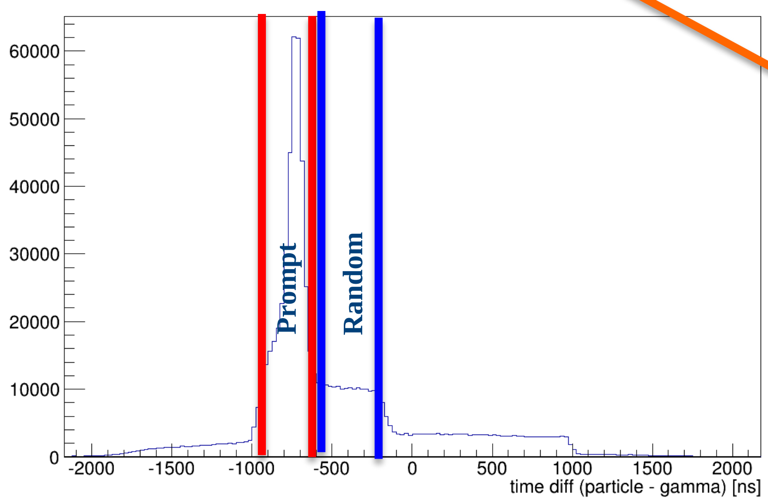


We observe the difference between 2.85 MeV/u and 4.0 MeV/u

First experiment at HIE-ISOLDE







"Prompt" Coincident

Using in the γ spectra

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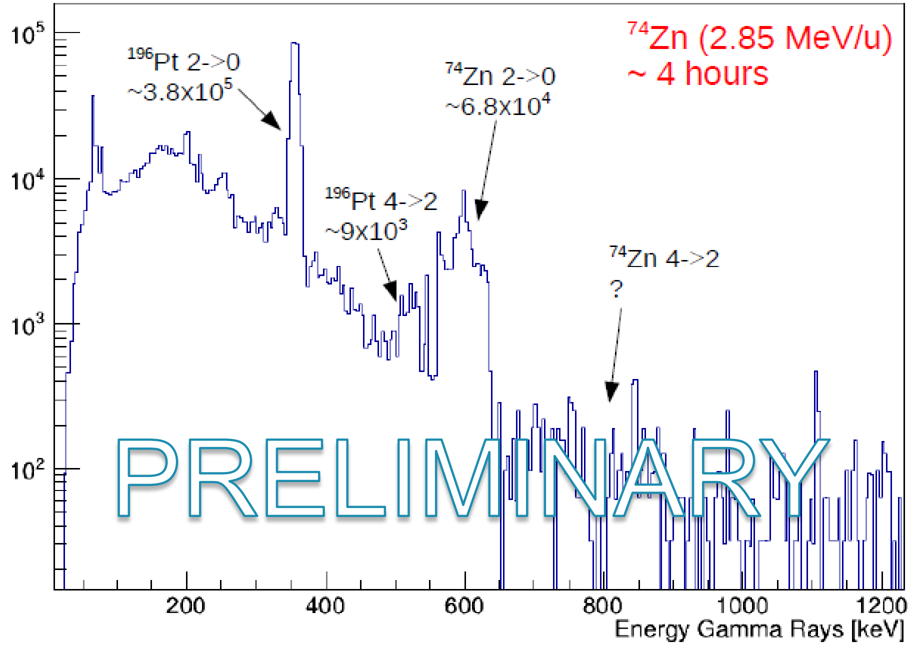
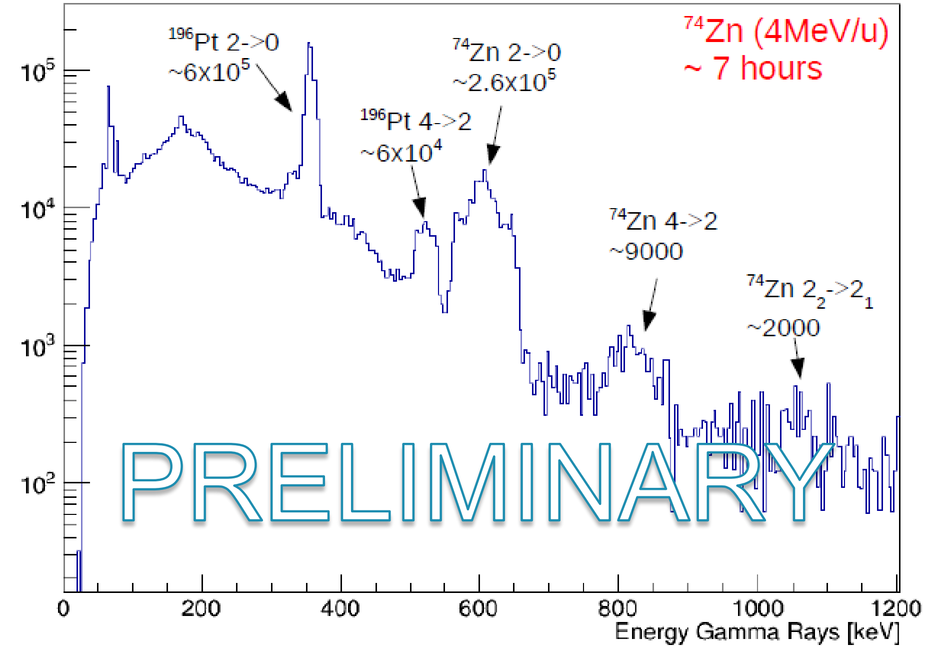
^{74}Zn on ^{196}Pt





THANKS FOR YOUR ATTENTION

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